THE MASSILLON COAL FIELD.

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Under the designation of the Massillon Coal Field, the most important mines of the Sharon coal (Coal No. 1), at present known in the State, will be considered. The field occupies adjacent portions of Summit, Medina, Wayne, and Stark counties. It extends from Tallmadge, Akron, and Wadsworth, on the north, nearly to the south line of Stark county. The coal of this seam is mined, or has been mined in the townships of Tallmadge, Springfield, Coventry, Franklin, Norton, and Copley, of Summit county; in Wadsworth township, of Medina county; in Chippewa and Baughman townships, of Wayne county; and in Lawrence, Jackson, Tuscarawas, Perry, Sugarcreek, and Bethlehem townships, of Stark county. A line can be drawn connecting the several mines that are, respectively, furthest north, east, south, and west within the area where this coal has been worked, and the space thus enclosed might be called a map of the Massillon Coal Field, but such a map would not answer for all of the purposes for which maps are made. Drill-holes and trial pits, sunk afterwards, would be quite likely to show basins of the coal in question, outside of the boundary, and they would not, by any means, be certain to show its presence at all points within the line. The reasons for this inadequacy are as follows: Much of the territory is drift-covered, and sharp boundaries of the underlying geological formations cannot be drawn. In the next place, most of the coal is below drainage. Finally and chiefly, the original deposits of the coal were exceedingly irregular, never covering but a small fraction of the area included in such a boundary line. In the accompanying map, which is entitled *Map of the Massillon Coal Field*, the locations of the principal mines are shown, but no symbols are ventured upon to indicate the extent and reach of the field. The map is based upon one prepared a number of years since by Mr. James Nicholls, mining engineer, for Dr. Newberry, to accompany a volume in course of preparation. In the accounts that follow of the several mining centers, the facts that are at hand bearing upon these questions will find place.

Newberry has given a good account of the field in his report upon Summit county, vol. I, page 214, *et. seq.*, and in his report upon Stark county, vol. III, pages 156–167, and also in his general discussions of the lowest coal. A knowledge of these previous statements will be presupposed in the descriptions that here find place.

That this seam is really at the Sharon horizon (Newberry's Coal No. 1), is established on the surest foundation. Every fact that can have a bearing on the question is in harmony with this view. The sections above and below are in exact accordance. Below lies the Sharon conglomerate, which is, however, a very uncertain element, being frequently replaced by sandstones and shales, without a pebble. Under the Conglomerate is the Waverly group, consisting of the Cuyahoga shales, the Berea shale, Berea grit and Bedford shale. All these are found in outcrop, and also in borings in due order, on every hand.

The coal itself, in its mode of accumulation, and its present disposition, agrees exactly with the Mahoning Valley coal. In physical properties the coal of the two fields differs somewhat, it is true, but no more than the most strictly continuous seams of the entire series will differ when traced through an equal extent of territory. The Massillon coal is in a great number of instances covered by a few feet of black shale; this is, in fact, the normal cover, and this slate is charged with the fossils that are characteristic of the seam elsewhere. Above the slate come the Sharon shales with their nodules of iron ore. These shales are very largely worked in Summit county for the manufacture of sewer pipe, and the character of the horizon is thus perfectly understood. The little "rider" seam of coal also comes into the sections frequently, 30 to 50 feet above the main coal. It is nowhere large enough to be mined, but there is no reason to doubt that it represents the Quakertown coal of the Mahoning Valley, which is Newberry's Coal No. 2. Still higher comes the Massillon sandstone, and above it, at the proper interval, the Mercer Group, the clearest and most unmistakable series of the Lower Coal Measures.

As this is the case with the Sharon coal seam elsewhere in Ohio, the coal of the Massillon field is in all cases disposed in distinct basins or troughs, which range in size from a few acres up to a

few hundred, but rarely exceeding two hundred acres; the greater number range between 30 and 70 acres. Each basin or trough holds a lenticular body of coal, the thickest part of which is generally at the center or along the axis of the basin, and which is known among the miners as the "swamp" of the seam. Toward the margins of the basins, the coal grows thin, sometimes gradually, and sometimes by rapid reduction in volume. As the seam is seldom followed by the miner when it runs below two feet in thickness, it is quite possible that some of the basins that appear to be distinct may in reality be connected through a thin sheet of coal that stretches over the "hills" of the mines. These basins are frequently grouped in close proximity, to the extent of a half dozen or more, but some appear to be separated by wide intervals from any other bodies of coal.

There is apparently a normal or regular thickness of the seam, for the swamps of all the important basins generally show about five feet of coal. The better mines yield about 4,500 tons to the acre by the present system of working.

The coal of the several basins is laid upon an uneven floor, and considerable differences of level are due to this fact, but in addition to this, the basins as a whole share in the inclination of the whole series of rocks in which they are included. In general terms, the dip of the coal may be said to be to the southeast, but there are many local exceptions to this statement. The margin of the Coal Measures is a sinuous one, and this fact is not altogether due to the accidents of atmospheric waste and erosion, but it seems to go back to original conditions of deposit. The dip of the coal basins adjusts itself in part to this margin, being generally at right angles to it, but in the large way all of them incline to the south and southeast.

The facts of the dip can be learned from an examination of the chart, which was prepared by Mr. James Nichols, under Dr. Newberry's direction. It is entitled *Map Showing Elevations of Massillon Coal, etc.*

The elevations of the coal are also shown herewith in tabular arrangement, to facilitate reference.

Beginning at the Akron mines, we find the following series:

	Above Lake Erie.
Coal of Brewster Bros. mine, Shaft	493.7 and 490 ft.
" " " mine, Drift	483.5
" Middlebury Shaft	464
" Brewster Slope	409
" Steese mine—Drift	419
" Johnson mine	419.3
" Franklin mine	421.8
" Krouse mine	391.7
" Chippewa mine	468
" Lester mine	448
" Fulton Slope	384
" Barney McGue's mine	388.9
" Crawford Slope	338.3
" Ground Hog mine	349.6
" Aberdare mine	334.5
" Mountain mine	318.5
" Willow Bank mine, No. 1	342.5
" Brookfield mine	341.2
" Grove mine	316
" Warmington mine	337
" Pigeon Run mine	322

The levels of the canal are also given to furnish a basis for comparison of other elements with those above enumerated:

	Above Lake Erie.
Summit level	396.66
Level from Wolf Creek to Clinton	387.66
" Clinton to Fulton	372.66
" Fulton to Massillon	366.66

In dealing with these figures, it is necessary to bear in mind that the elevations of the coal in different parts of the same mine have a play of 20 to 50 feet, irrespective of any general dip. The descent is often made very abruptly. This fact will remove some of the anomalies in the previous table.

From the northernmost station, which is the Middlebury mine, to Krouse's mine, section 22, Franklin township, there is a descent of 72.3 feet. The distance is ten miles, and the direction is nearly southwest. This shows the fall in this line to be 7 feet per mile. But from the same station to the Franklin mine there is a descent of only 42.2 feet in 8½ miles. This reduces the dip in the same general line to 5 feet per mile. The latter figure is the more reliable, as a number of elevations agree with that of Franklin.

From the Krouse mine to the Chippewa mine, the distance is 5½ miles, and the direction is southwest as before, but the coal rises in this interval 76.3 feet. The Franklin coal is but 46.2 feet lower than the Chippewa coal. The dip from Chippewa to Franklin is about 6½ feet per mile. Chippewa and Middlebury coals being at the same level, the line that connects them may well enough be taken as the line of strike or level bearing. This agrees fairly well with the general facts of the dip in this region.

To ascertain the strongest dip, the elevations of the Chippewa mine; 468 feet, and of the Mountain mine, 318.5 feet, and also of Willow Bank, No. 1, 342.5 feet, can be compared. The distance is about 7½ miles. The direction from the Chippewa to the Mountain mine is nearly southeast, and the descent is 147.5 feet, or about 20 feet per mile, but to the Willow Bank coal, which is west of the Mountain, the fall is only 125 feet, or about 16 feet to the mile. From the Lester mine, which is near the Chippewa, but which holds a lower level (448), the fall to the Mountain mine is at the rate of seventeen feet per mile, and to the Willow Bank about fourteen feet per mile. The most southerly mines that appear in the list, as the Grove, Warmington, and Pigeon Run, we find to the west of the main line of dip, above noted, and lying nearly level on a north and south line with the mines nearest Massillon. It is seen from these comparisons and from such others as the figures of the preceding table render possible, that while the dip is not nearly enough uniform in any direction to warrant its employment in determining the position of the coal at new stations, still no great anomalies are found; and, least of all, does it tend to high figures.

The Massillon coal is an open-burning coal, containing an average of about 53½ per cent. of fixed carbon, 37 per cent. of volatile combustible matter, 5½ per cent. of moisture, and 4 per cent. of ash. The fixed carbon ranges from 50 to 57 per cent. The volatile combustible matter is quite uniform, seldom rising above 38, nor falling below 35 per cent. The moisture has not been found lower than 4½, nor higher than 6¼ per cent. A wider range is shown in the ash, the limits of the analyses made for the Survey being respectively 1.6 and 6.3 per cent. The percentage of sulphur is about 1.1. These figures evidently show one of the very best coals of the State. As will be hereafter seen, there are some

large basins that fall a little below the standard in quality. It is an open-burning coal, but not of the same character as the Mahoning Valley seam. From the latter it is distinguished by its larger proportion of bituminous matter as shown by its burning with a longer flame. It is also a brighter coal, holding much less mineral charcoal. Its open-burning character is, however, pronounced, and it has long been used successfully in the blast-furnace as a smelting fuel. It is the dryer or splintier portion of the seam that is turned to this use. It is well faced, so far as the main joints are concerned, but the end joints or "cutters" are very close and tight. This fact has led to a system of mining different from any that is elsewhere followed in the State. The coal is blasted without being undermined, and sometimes without being "sheared," or, in mining phrase, it is "shot out of the solid." The undermining can well enough be dispensed with, but the shearing or cutting of the coal is essential to good mining. More powder is required to the ton of coal in this field than in any other in Ohio. The most coal that can be expected from a keg of powder is 35 tons, and the amount is sometimes reduced to 20 tons. At these rates, the cost of powder to the miner ranges between 9 and 16 cents for each ton of coal.

Royalty ranges between 15 and 30 cents per ton, and is paid on lump or round coal in nearly all cases at the present time. Screens are in universal use for cleaning the coal. The standard commonly recognized, is 12 feet by 5 feet, with a mesh of 1⅛ to 1¼ inches, but this last element has some range. It never falls below the standard, but often overruns. The amount that goes through the screens differs in different mines. Generally from one-third to one-fifth of what is sent out in the bank cars is found below the screens. Of this amount about half, sometimes more and sometimes less, is nut coal. South of Massillon the output is divided thus: one car of nut to nine of lump; one of slack to seven of lump. The nut derived from the curly coal is more valuable than that from the splinty coal, the former selling at the mine about 40 cents, and the latter about 65 cents below the lump coal. In the city markets, these distinctions are apt to vanish, and the price of both grades comes within twenty-five cents of the lump coal. Within the last few years a market has been made for the slack also. The entire product of the mines now goes forward. Throughout the field, the

face of the coal is often encrusted with a thin film of carbonate of lime, which is commonly known as white cap. As to its effect upon the strength of the coal, there is a difference of opinion In some mines it is held to reduce the strength of the coal, causing the seam to yield more nut and slack. In others it is claimed that the coal is cemented at the joints by this means and is thus enabled to bear handling with less loss. It is quite a distinctive mark of the coal in the lake markets, but it is not limited to this seam as is popularly held.

The usual price of mining is 85 cents per ton, with an allowance of 4 cents for every 3 inches below 4 feet. The miner makes from 2 to 4 tons per day of clean coal.

A coal of the character already described is seen to be adapted to almost all of the important uses to which bituminous coals are put. It is an improved furnace and mill coal, and a steam coal of high grade, but for household use it is so happily adapted that not only is it the standard in this respect in the markets that it reaches, but a constantly increasing percentage of it is being turned to this service. The proportion now used as domestic coal is variously estimated at 60 to 80 per cent. Its adaptations to household use have been already pointed out. It is to be regretted that any large amounts of a coal of such high grade, and which exists in such limited quantity, should be used up in the manufacture of steam in locomotive and stationary engines, for which far inferior qualities are available, but this result follows necessarily from the present state of the coal market, and a considerable amount of the comparatively small acreage left of this famous field is annually turned to these inferior uses. But little of it is used in blast-furnaces at the present time.